Math Virtual Learning

College Prep Algebra

May 21, 2020

College Prep Algebra
Lesson: May 21, 2020

Objective/Learning Target:
- I can write an equation to transform a parent function from a given Domain and Range
- I can determine the Domain and Range of a transformed parent function from its equation.
- I can use order of operations to verbally describe transformations.

Let's Get Started:
From May 15 to May 20, you worked on

- Parent Functions
- Horizontal Transformations
- Vertical Transformations
- Vertical Compressions and Stretches
- Horizontal Compressions and Stretches
- Reflections across the x-axis and y-axis
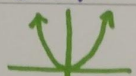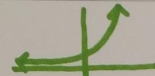- Parent Function Domain and Range

Let's Get Started:
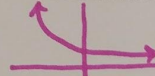
During those lesson you were encouraged to create Reference Pages for
- Parent Functions
- Transformations.

The next two slides have the same examples of Reference Pages as May 20

Do this on notebook paper for you to reference for the remainder of the lessons.

Parent Functions Reference Page

✱ Parent Functions ✱

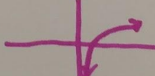| Equation	Name	Graph	Domain	Range
$f(x) = x^2$	Quadratic		All Reals	$y \geq 0$
$f(x) = x^3$	Cubic		All Reals	All Reals
$f(x) = |x|$	Absolute Value		All Reals	$y \geq 0$
$f(x) = (2)^x$	Exponential Growth		All Reals	$y > 0$
$f(x) = \left(\frac{1}{2}\right)^x$	Exponential Decay		All Reals	$y > 0$
$f(x) = \sqrt[3]{x}$	Cube root		All Reals	All Reals
$f(x) = \sqrt{x}$	Square Root		$x \geq 0$	$y \geq 0$
$f(x) = \log_2(x)$	Logarithmic		$x > 0$	All Reals
$f(x) = \frac{1}{x}$	Rational/ Inverse		All Reals but $x \neq 0$	All Reals but $y \neq 0$
$f(x) = \frac{1}{x^2}$	Rational (even power)		All Reals but $x \neq 0$	$y > 0$

Parent Functions Transformations Reference Page

✳ Transforming Parent Functions ✳

Rule Change	Transformation	Domain Change	Range Change
$f(x)+k$	Vertical shift up "K" units	None	If NOT Reals, the O changes to "k"
$f(x)-K$	Vertical Shift down "k" units	None	If NOT Reals, the O changes to neg. "k"
$f(x-h)$	Horizontal Shift RIGHT "h" units	If NOT Reals, the O changes to "h"	None
$f(x+h)$	Horizontal Shift LEFT "h" units	If NOT Reals the O changes to neg. "h"	None
$-f(x)$	Reflect across ~~y-axis~~ x-axis	None	If NOT Reals, the inequalities become < or ≤
$f(-x)$	Reflect across y-axis	If NOT Reals the inequalities becom < or ≤	None
$a \cdot f(x),$ $a > 1$	Vertical Stretch	None	None
$f(a \cdot x),$ $a < 1$	Horizontal Stretch	None	None
$a \cdot f(x),$ $0 < a < 1$	Vertical Compression	None	None
$f(a \cdot x),$ $a > 1$	Horizontal Compression	None	None

Lesson:
Did you know the order of operations you learned in middle school apply when describing transformations?

When you are asked to graph a transformation by hand, you must follow order of operations.

An easy way to think of it with transformations is to always start with *x*.

- Does *x* have any numbers multiplying it?
- Is a number adding or subtracting the *x*?
- Is there a number multiplying the entire function?
- Is there a number adding or subtracting the entire function?

Lesson:

Describe the transformation for $f(x) = -\frac{1}{2}\sqrt{4x + 1} - 7$

All I did was read across—left to right . . . is that wrong?

- Reflect across x-axis
- Vertically Compress
- Horizontally Compress
- Shift left one
- Shift down one

UNFORTUNATELY YES...

Lesson:

Describe the transformation for $f(x) = -\frac{1}{2}\sqrt{4x + 1} - 7$

Start with just *x*.

Then describe what happens to the *x* as the problem develops. You already know the shape is square root, so you only describe the "moves" the shape makes

$\sqrt{x}$

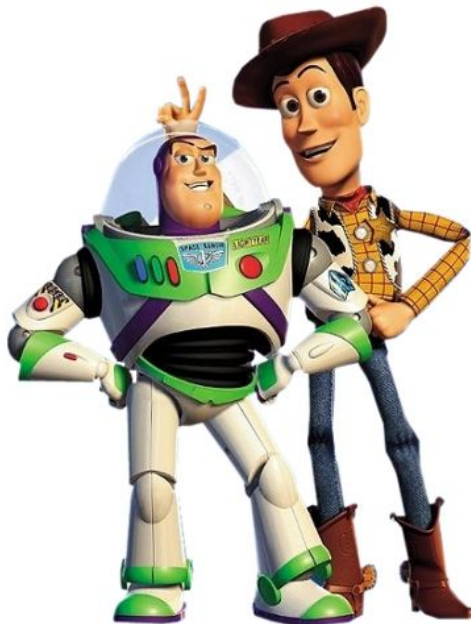$\sqrt{4x}$ Compress horizontally

$\sqrt{4x + 1}$ Shift left one

$-\frac{1}{2}\sqrt{4x + 1}$ Reflect across x-axis, compress vertically

$-\frac{1}{2}\sqrt{4x + 1} - 7$ Shift down seven

Lesson: Try this transformation and then check on the next slide!

Describe the transformation for

$$f(x) = 2(x - 9)^2 - 1$$

Lesson: ANSWER

Describe the transformation for

$$f(x) = 2(x - 9)^2 - 1$$

x^2

$(x - 9)^2$ Shift right 9

$2(x - 9)^2$ Stretch Vertically
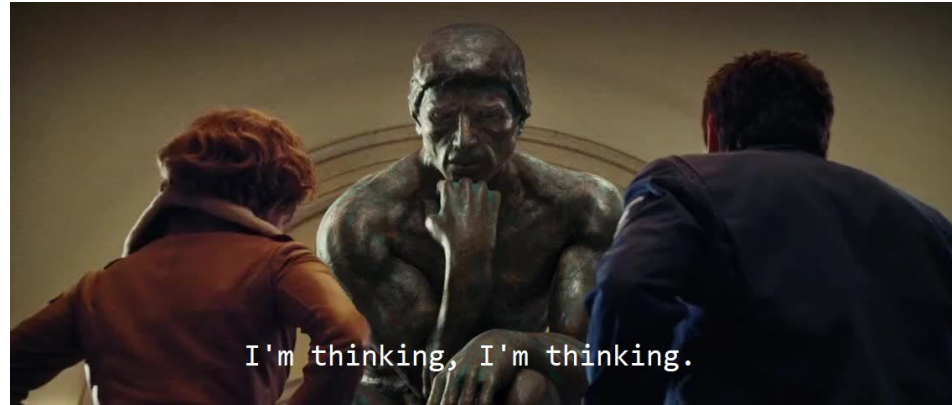
$2(x - 9)^2 - 1$ Shift down 1

Lesson:

You should also be able to describe a transformation and write an equation of the transformation when the only information you are given is the Domain and Range!

For example

What Absolute Value Equation would have—
- Domain: All Reals
- Range: y is greater than -10

I'm thinking, I'm thinking.

Lesson:

What Absolute Value Equation would have—

- **Domain: All Reals**
- **Range: y is greater than -10**

$$f(x) = |x| - 10$$
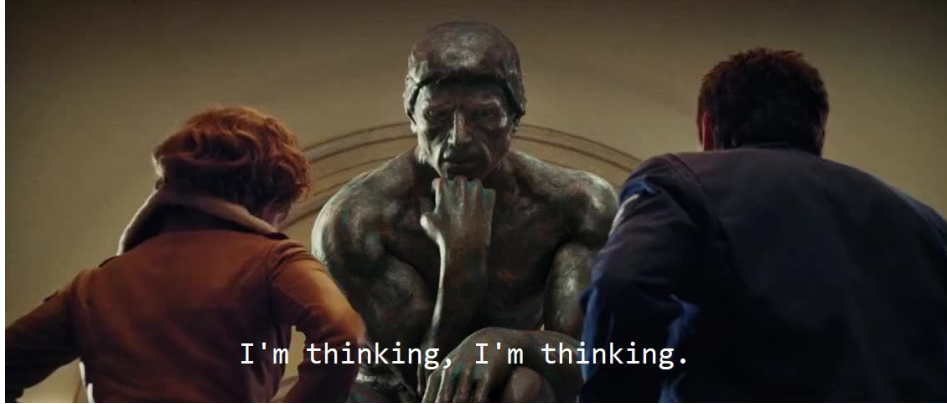
- *The <u>parent function</u> has a Range of y is greater than 0.*
- *So I know it went down vertically 10.*
- *No other change happened which means . . .*

Lesson:

Example 2

What Square Root Equation would have—
- Domain: x is less than 0
- Range: y is less than 4

I'm thinking, I'm thinking.

Lesson:

What Square Root Equation would have—
- **Domain: *x* is less than or equal to 0**
- **Range: *y* is less than or equal to 4**

$$f(x) = -\sqrt{-x} + 4$$

- *The <u>parent function</u> has a Domain of "x is greater than or equal to 0" and a Range of "y is greater than or equal to 0".*

- *Since both of the "greater thans" changed to "less thans" I know there are reflections across both the x-axis and y-axis*

- *The Range has shifted up to 4*

Practice:

Try these 20 problems to see how you do.

Use your Reference Sheets to support you in your work.

[Practice Transforming with
Order of Operations and from Domain and Range
With Answer Key](#)